



DECLARATION

I, Bong Seok SEO, a Patent Attorney in Korea of 9th Fl., Seolim Bldg., 649-10, Youksam-Dong, Gangnam-Gu, Seoul, Korea, hereby declare that I am the translator of the Korean Patent Application No. P2003-53145 that the followings are true translation to the best of my knowledge and belief

SIGNATURE

A handwritten signature in black ink, appearing to read "Bong Seok SEO", written over a horizontal line.

Bong Seok SEO

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【 ABSTRACT 】

A refrigerator with an improved door-closing device to reduce abrasion of associated components due to opening and closing operations of a door and thus noise due to abrasion, as well as to achieve a more neat appearance. The refrigerator includes a cabinet having either a pair of hinge shafts or a pair of hinge holes, a door having the other pair of hinge holes or hinge shafts and swingably coupled to the cabinet by the engagement between the pair of hinge shafts and the pair of hinge holes, and a door-closing device to allow the door to be automatically closed toward the cabinet. The door-closing device includes an auxiliary hinge shaft attached to the door, a restoring unit to bias the door toward the cabinet to be closed when the door is opened, a hinge lever connected between the auxiliary shaft and the restoring unit and having a coupling hole in which the auxiliary hinge shaft is fitted, and a cap fitted on an end of the hinge lever at which the coupling hole is formed.

【 REPRESENTATIVE DRAWING 】

Figure 2



【 SPECIFICATION 】

【 TITLE OF THE INVENTION 】 REFRIGERATOR

【 BRIEF DESCRIPTION OF THE DRAWINGS 】

FIG. 1 is an exploded perspective view of a door-closing device of a refrigerator, according to an embodiment of the present invention; and

FIG. 2 is a cross-sectional view of the door-closing device of the refrigerator shown in FIG. 1.

*** Description of Reference Numerals For Important Parts***

20: door	30: hinge shaft bracket
31: hinge shaft	32: auxiliary hinge shaft
32a: coupling portion	40: hinge hole brackets
41: hinge hole	50: hinge lever
52: coupling hole	70: grommet
71: flange	80: cap
81: slot	82: through-holes
90: grease container	

【 DETAILED DESCRIPTION OF THE INVENTION 】

【 OBJECT OF THE INVENTION 】

【 FIELD OF THE INVENTION AND PRIOR ART 】

The present invention relates to a refrigerator and, more particularly, to a door-closing device for a refrigerator, which is designed to enable a door of the refrigerator to be automatically closed when the door is opened by a predetermined angle or less.

Generally, a refrigerator generates cool air by a refrigerating cycle, and supplies the cool air into storage compartments, so as to maintain the freshness of food stored in the storage compartments for a desired period of time.

A typical refrigerator includes a cabinet opening at a front face thereof and having storage compartments therein, and a door hingedly coupled to the front face of the cabinet to open and close the storage compartments.

The door includes upper and lower hinge shafts joined to both ends of a side thereof, which serve as a rotating axis, and the cabinet includes upper and lower hinge holes at upper and lower panels thereof, corresponding to the upper and lower hinge shafts. Accordingly, the door is swingably coupled to the cabinet by the upper and lower hinge shafts fitted in

the hinge holes, to open and close the storage compartment.

Among the conventional refrigerators, there is a refrigerator having a door-closing device, which functions to allow a door to be automatically closed when the door is opened by a predetermined angle or less. The door-closing device is designed to allow the door to be automatically closed even when the door is not correctly closed due to a user's carelessness, thereby preventing cool air in the storage compartments of the refrigerator from leaking.

The door-closing device includes a hinge bracket attached to a lower end of the door and having a hinge shaft and an auxiliary hinge shaft spaced apart from the hinge shaft, and an actuating lever attached to the cabinet and hingedly connected to the auxiliary hinge shaft at the front end of the actuating lever. A restoring unit is provided at a rear end of the actuating lever, so as to retract the actuating lever into the cabinet when the door is opened. Accordingly, when the door is opened by a predetermined angle or less, the actuating lever is rearwardly moved by the stored potential energy of the restoring unit, thereby allowing the door, connected to the actuating lever via the auxiliary hinge shaft to be automatically closed.

The actuating lever includes a coupling hole in which the auxiliary hinge shaft is fitted. A grommet, which is adapted to sheathe the auxiliary hinge shaft, is fitted into the coupling hole of the actuating lever, so as to prevent abrasion of the auxiliary hinge shaft and the actuating lever during opening and closing operations of the door. The lower end of the auxiliary hinge shaft is provided with a coupling portion having an external diameter smaller than that of the remaining portion of the auxiliary hinge shaft, so as to enable the coupling portion to be fitted into the grommet. Since the grommet includes a flange at an upper end thereof, which is supported on an upper surface of the actuating lever adjacent to the coupling hole, the grommet is stably retained in the coupling hole of the actuating lever without separation from the actuating lever.

In the conventional refrigerator, although grease is usually applied to the coupling hole of the actuating lever, into which the grommet and the auxiliary hinge shaft are fitted, so as to facilitate opening and closing operations of the door and to prevent abrasion of the components associated with the coupling hole, the grease applied to the coupling hole and the ac

tuating lever may detract from the appearance of the cabinet because extraneous substances such as dust are apt to adhere to the grease due to its being exposed to the external environment.

Furthermore, since the grommet is made of a plastic material produced by injection molding while the auxiliary hinge shaft and the actuating lever are made of metal, the flange of the grommet, which is interposed between the auxiliary hinge shaft and the actuating lever, is apt to wear and thus to generate undesired noise, due to the repeated opening and closing operations of the door.

【TECHNICAL TASK OF THE INVENTION】

Accordingly, it is an aspect of the present invention to provide a refrigerator with an improved door-closing device to reduce abrasion of components associated with the door-closing device due to opening and closing operations of a door and thus noise due to the abrasion, as well as to achieve a more esthetically pleasing appearance.

【CONSTRUCTION AND OPERATION OF THE INVENTION】

In order to accomplish the above objects, the present invention provides a refrigerator including a cabinet having either a pair of hinge shafts or a pair of hinge holes, a door having the other pair of hinge holes or hinge shafts and swingably coupled to the cabinet by the engagement between the pair of hinge shafts and the pair of hinge holes, and a door-closing device to allow the door to be automatically closed toward the cabinet, the door-closing device including an auxiliary hinge shaft attached to the door, a restoring unit to bias the door toward the cabinet to be closed when the door is opened, a hinge lever connected between the auxiliary shaft and the restoring unit and having a coupling hole in which the auxiliary hinge shaft is fitted, and a cap fitted on an end of the hinge lever at which the coupling hole is formed.

The refrigerator may further include a grommet fitted in the coupling hole of the hinge lever and in which the auxiliary hinge shaft is fitted. An upper end of the grommet is provided with a flange, which is radially extended from the grommet and supported on the hinge lever with the cap being interposed therebetween.

The refrigerator may further include a grease container attached to a lower surface of the cap and opened at the top thereof, to hold grease therein.

An internal diameter of the grease container may be larger than a diameter of the coupling hole.

The cap may include a slot at a side thereof to allow the hinge lever to be fitted in the cap through the slot, and the cap may include upper and lower through-holes formed at upper and lower walls of the cap to allow the auxiliary hinge shaft to pass therethrough.

Reference will now be made in detail to the present preferred embodiment of the present invention, an example of which is illustrated in the accompanying drawing, wherein like reference numerals refer to like elements throughout.

As shown in FIG. 1, a refrigerator according to an embodiment of the present invention includes a cabinet 10 opening at a front face thereof and having a storage compartment 11 therein, and a door 20 hingedly coupled to the front face of the cabinet 10 to open and close the storage compartment 11.

The door 20 includes a pair of hinge shaft brackets 30 at upper and lower ends of a side thereof, in which each of the hinge shaft brackets 30 includes a main hinge shaft 31 serving as the rotating axis of the door 20. The cabinet 10 is provided with a pair of hinge hole brackets 40 at locations corresponding to the pair of hinge shaft brackets 30, each of the hinge hole brackets 40 having a hinge hole 41 corresponding to the hinge shaft 31, so as to allow the hinge shafts 31 of the hinge shaft brackets 30 to be rotatably fitted in the hinge holes 41 of the hinge hole brackets 40. By the hinge arrangement, the door 20 is rotated about the hinge shafts 31 fitted in the hinge holes 41, thus opening and closing the storage compartment 11.

The refrigerator according to this embodiment of the present invention further includes a door-closing device, which is adapted to allow the door 20 to be automatically closed toward the cabinet 10, when the door is opened about the hinge shafts 31 by a predetermined angle or less.

The door-closing device includes an auxiliary hinge shaft 32 provided on the lower hinge shaft bracket 30 to be spaced apart from the main hinge shaft 31, a hinge lever 50 provided at a lower portion of the cabinet 10 and hingedly connected at a front end thereof to the auxiliary shaft 32, and a restoring unit 60 hingedly connected to a rear end of the hinge lever 50, so as to restore the hinge lever 50 to the rest position when the

e hinge lever 50 is moved forward by opening of the door 50.

The restoring unit 60 includes a movable rod 61 connected at a front end thereof to the rear end of the hinge lever 50 and having a piston part (not shown) provided at a rear end thereof, and a housing 62 to receive the piston part (not shown) of the movable rod 61 therein. The housing 62 is swingably connected to a mount plate 63 fixed to a lower end of the cabinet 10. The movable rod 61 is provided with an elastic member 63 fitted on an outer surface of the movable rod 61. The elastic member 63 is secured at a front end thereof to the front end of the movable rod 61, and secured at a rear end thereof to the housing 62. The elastic member 63 biases the movable rod 61 rearward, thereby causing the door 20 to be closed. The hinge lever 50 is bent at a middle portion thereof, such that the door 20 is automatically closed when the door 20 is opened by a predetermined angle or less, but is maintained in the opened position when the door 20 is opened more than the predetermined angle. Accordingly, when the door 20 is opened by a predetermined angle or less, the hinge lever 50 is retracted into the cabinet 10 by the restoring unit 60, thereby allowing the door 20, connected to the hinge lever 50 via the auxiliary shaft 32, to be automatically closed.

The front end of the hinge lever 50 is formed with a coupling hole 52, so as to enable the auxiliary hinge shaft 32 to be rotatably fitted in the coupling hole 52. A cylindrical grommet 70 is fitted in the coupling hole 52 of the hinge lever 50 to prevent abrasion of contacting surfaces between the auxiliary shaft 32 and the edge of the coupling hole 52.

A lower end of the auxiliary hinge shaft 32 is provided with a coupling portion 32a having a reduced external diameter, to allow the lower end of the auxiliary hinge shaft 32 to be fitted in the grommet 70. The grommet 70 includes an upper flange 71 to prevent the grommet 70 fitted in the coupling hole 52 of the hinge lever 50 from being downwardly separated from the coupling hole 52. Therefore, it is possible to avoid direct contact between the auxiliary hinge shaft 32 and the edge of the coupling hole 52 of the hinge lever 50 by the interposition of the grommet 70.

To diminish noise due to opening and closing operations of the door 20 as well as to prevent abrasion of the edge of the coupling hole 52 of the hinge lever 50, the grommet 70 fitted in the coupling hole 52, and the auxiliary hinge shaft 32, grease is applied to the coupling hole 52 of the

hinge lever 50 and the grommet 70. The front end of the hinge lever 50, where the coupling hole 50 is formed, is sheathed with a cap 80, so as to prevent the grease applied to the components from being exposed to the outside.

The cap 80 is fitted on the front end of the hinge lever 50. To this end, the cap 80 is formed at a rear side thereof with a slot 81, and is formed at upper and lower surfaces thereof with through-holes 82.

Since the refrigerator prevents the grease, applied to the components associated with the coupling hole 52, from being exposed, due to the cap 80, the refrigerator has a more neat appearance. Furthermore, since the cap 80 is fitted on the hinge lever 50 prior to the auxiliary hinge shaft 32 and the grommet 70 being inserted into the coupling hole 52 of the hinge lever 50, and the grommet 70 is fitted in the coupling hole 52 of the hinge lever 50 such that the flange 71 of the grommet 70 is supported on an upper wall of the cap 80, it is possible to prevent abrasion of the flange 71 of the grommet 70 during opening and closing operations of the door 20.

In a conventional hinge arrangement, since the grommet 70 is made of a plastic material produced by an injection molding process, and the flange 71 of the grommet 70 is in direct contact with an upper surface of the hinge lever 50, the plastic flange 71 is apt to wear.

On the contrary, in this embodiment of the present invention, since the upper wall of the cap 80 is interposed between the flange 71 and the hinge lever 50, as shown in FIG. 2, the flange 71 of the grommet 70 is prevented from directly contacting the hinge lever 50. Accordingly, even though the door 20 is repeatedly opened and closed over a long period of time, abrasion of the flange 71 of the grommet 70 due to contact with the hinge lever 50 is prevented, and thus abnormal noise due to abrasion is diminished.

A grease container 90 is attached to a lower surface of the cap 80, to contain grease therein. The grease held in the grease container 90 permeates into a gap between the auxiliary shaft 32 and the grommet 70 and a gap between the grommet 70 and the hinge lever 50, thereby diminishing abrasion of the components and thus noise due to the abrasion.

A washer 91 is further provided on a lower surface of the grease container 90. The washer 91 and the grease container 90 are attached to

the lower surface of the cap 80 by a screw 92, which passes through the washer 91 and the grease container 90 and is fixed to the auxiliary hinge shaft 32. At this point, an internal diameter of the grease container 90 is preferably larger than a diameter of the coupling hole 52, so as to allow the grease to drop into the grease container 90 thus preventing the grease from dropping on a floor in the case that the grease drips. In the drawings, a reference numeral 42 indicates a washer interposed between the hinge shaft 32 and the hinge hole bracket 40.

Assembly operation of the door-closing device of the refrigerator according to an embodiment of the present invention will now be described.

First, a certain amount of grease is applied to inner surface of the cap 80, and the front end, having the coupling hole 52, is inserted into the cap through the slot 81. As a result, the through-holes 82 formed at the upper and lower walls of the cap 80 are aligned with the coupling hole 52 of the hinge lever 50. Subsequently, the rear end of the hinge lever 50 is connected to the front end of the movable rod 61 of the restoring unit.

Thereafter, the grommet 70, to the outer surface of which grease has been applied, is fitted into the coupling hole 52 of the hinge lever 50 through the through-hole 82 of the cap 80. At this time, the flange 71 of the grommet 70 is caught on the upper surface of the cap 80 adjacent to the through-hole 82, and thus supported thereon.

Thereafter, the door 20 is mounted on the cabinet 10 in such a way that the hinge shaft 31 of the hinge shaft bracket 30 attached to the door 20 is fitted into the hinge hole 41 of the hinge hole bracket 40 attached to the cabinet 10 while the coupling portions 32a of the auxiliary hinge shaft 32 with the grommet 70 sheathed thereon is fitted into the coupling hole 52 of the hinge lever 50.

Subsequently, the grease container 90 filled with a certain amount of grease is disposed under the cap 80, and the washer 91 is disposed under the grease container 90. Finally, the grease container 90 is firmly attached to the lower surface of the cap 80 by tightening the screw 92 into the auxiliary hinge shaft 32 through the washer 91 and the grease container 90.

After completely assembled, when the door 20 is opened by a predetermined angle or less, the hinge lever 50 is rearwardly retracted into the

cabinet 10 by the restoring unit 60, whereby the door 20, which is connected to the hinge lever 50 via the auxiliary hinge shaft 32, is automatically closed by the retraction of the hinge lever 50.

As apparent from the above description, the present invention provides a door-closing device for a refrigerator, in which a hinge lever 50 is sheathed with a cap 80, an upper wall of which is interposed between a flange 71 of a grommet 70 and the hinge lever 50. Accordingly, since grease applied to a coupling hole 52 of the hinge lever 50 is not exposed to the external environment, an external appearance of the refrigerator becomes neat. Furthermore, since the flange 71 of the grommet 70 does not directly contact the hinge lever 50 due to the cap 50 interposed therebetween, abrasion of the flange 71 of the plastic grommet 70 due to the direct contact with the hinge lever 50 during opening and closing operations of the door is prevented, thereby reducing undesired noise.

In addition, since the hinge arrangement is provided with an additional grease container 90 containing grease therein, the abrasion of the associated components and the noise due to the abrasion are more efficiently reduced or prevented.

Although a preferred embodiment of the present invention has been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

【EFFECT OF THE INVENTION】

As described above, the present invention provides a refrigerator, in which a cap of door-closing device is provided with the coupling hole of the hinge lever. Accordingly, since grease applied to a coupling hole of the hinge lever is not exposed to the external environment, an external appearance of the refrigerator becomes neat. Furthermore, since the upper wall of the cap is interposed between the flange of the plastic grommet and the flange of the metallic hinge lever, abrasion of the flange of the grommet is prevented and thereby reducing undesired noise.

【CLAIMS】

【CLAIM 1】 A refrigerator including a cabinet having either a pair of hinge shafts or a pair of hinge holes, a door having the other pair of hinge holes or hinge shafts and swingably coupled to the cabinet by the engagement between the pair of hinge shafts and the pair of hinge holes, and a door-closing device to allow the door to be automatically closed toward the cabinet, the door-closing device comprising:

an auxiliary hinge shaft attached to the door;

a restoring unit to bias the door toward the cabinet to be closed when the door is opened;

a hinge lever connected between the auxiliary hinge shaft and the restoring unit and having a coupling hole in which the auxiliary hinge shaft is fitted; and

a cap fitted on an end of the hinge lever at which the coupling hole is formed.

【CLAIM 2】 The refrigerator as set forth in claim 1, further comprising a grommet fitted in the coupling hole of the hinge lever and in which the auxiliary hinge shaft is fitted, an upper end of the grommet being provided with a flange, which is radially extended from the grommet and supported on the hinge lever with the cap being interposed therebetween.

【CLAIM 3】 The refrigerator as set forth in claim 1, further comprising a grease container attached to a lower surface of the cap and opened at the top thereof, to hold grease therein.

【CLAIM 4】 The refrigerator as set forth in claim 3, wherein an internal diameter of the grease container is larger than a diameter of the coupling hole.

【CLAIM 5】 The refrigerator as set forth in claim 1, wherein the cap includes a slot at a side thereof to allow the hinge lever to be fitted in the cap through the slot, and the cap includes upper and lower through-holes formed at upper and lower walls of the cap to allow the auxiliary hinge shaft to pass therethrough.